

JOHNS HOPKINS HOSPITAL.

REPORTS AND PAPERS

RELATING TO

CONSTRUCTION AND ORGANIZATION.

No. 1.

WASHINGTON, D. C., July 15, 1876.

MR. FRANCIS T. KING,

President of the Johns Hopkins Hospital.

DEAR SIR :

In accordance with your request I have carefully examined the various plans and drawings prepared by your Architect, in conjunction with the Building Committee for the Johns Hopkins Hospital, and have considered some of the questions to which they give rise.

Although the time occupied in this has been but brief, I have been led to certain conclusions which I think should be presented and decided upon as soon as convenient, in order that the Architect and myself can go on to the best advantage, and for this reason I submit this preliminary report.

As I understand it, the Building Committee have informally decided certain points with regard to the general plan, and these decisions, all of which I accept, and make the basis of my calculations, are as follows :

I. That the main administration building shall front on Broadway, and that its centre shall come opposite the centre of McElderry street.

II. That a special feature of the Hospital shall be a large, open central space, ornamented with trees, flowers, a fountain, etc.

III. That the main or Broadway front shall form the memorial or monumental part of the structure, and shall consist of handsome, though not elaborately ornamented buildings.

IV. That the buildings of the Hospital shall be brick.

V. That the south ends of all wards shall be clear of rooms or buildings, and be fully exposed to air and light.

VI. That the wards and main administration buildings shall be connected by corridors, the top of which shall rise to, but not above, the floor level of the wards, and the floors of which shall be level, and entirely above the surface of the ground.

Taking these six points as agreed upon, I think that the general system of grades and levels, with the arrangement of buildings, proposed by your Architect, is satisfactory and is the result of much skill and ingenuity in overcoming the peculiar difficulties presented by the warped surface of the lot. Certainly I am not able to suggest any improvement at present.

It appears to me that the next question to be decided is that of cost, or perhaps I had better state it thus: Do the the Board desire that good, substantial buildings be erected on this plan, making cost a secondary consideration, or do they wish to limit the amount and require that the plans or quality of buildings shall be reduced to come within the limit?

My object in this paper is to present certain data and considerations which may assist in answering this question.

At my request your Architect has made an estimate of cost for this plan, calculating for plain but good and substantial work and omitting all architectural ornament and decoration, except for the main front or memorial buildings.

A copy is herewith submitted marked A, as also a detailed estimate for a single pavilion marked B.

I believe this estimate to be too low, and that it is most probable that the Hospital, completed on this plan and furnished, will cost about twelve hundred thousand dollars (1,200,000). As it is necessary, by the terms of the trust, that the expense of construction shall be met from annual income, and as the first year's income has been wisely applied to enlarging the grounds, by the purchase of the two adjoining squares on Broadway, it follows that if this plan be adopted, the Hospital cannot be ready for operations before the autumn of 1880.

Two courses are open to the Trustees. The first is to accept the estimates offered as being as nearly as correct as such things can be at this time, to approve the general plan and arrangement now prepared, and to authorize the commencement of study of details and preparation of working drawings on the basis of these estimates.

The question may be asked, "Shall the Hospital be completed before any patients are received?" I will consider this question in the latter part of this paper.

The second course which may be taken by the Trustees is to decide that the buildings *must* be put up more cheaply.

Let us consider in what way we can reduce the expense. If I comprehend the wishes and intentions of the Trustees, but a small reduction can be made on the administration building, the pay wards, kitchen, nurses' building, amphitheatre, physicians' building, and the grading and sewerage.

The cost of these, as per estimate, is \$497,000. I do not think that this can be reduced more than \$47,000, and make the buildings such as will satisfy the Trustees, which would leave for these \$450,000.

Turning now to the wards, if these are built with common red brick, nine-inch walls, pine joists, common plastering, wooden stairs, single sash windows, in short with

cheap work and materials in every respect, except the plumbing and heating apparatus, which should in any case be first-class, we might reduce the cost of each ward and service building to about \$16,000.

Twelve of these then would be.....\$192,000

The two isolation wards may in like manner be reduced to..... 48,000

If the connecting corridors are not fire-proof, but as cheap as possible, they will cost, say..... 15,000

The remaining buildings, estimated by the Architect at \$57,700, would be reduced to..... 40,000

The foul air ducts and central shaft would be omitted. The cost of enclosing wall, fence and gates cannot be reduced much. It has been proposed to omit it altogether and make the ground an open park, but I am sure that the result would be extremely unsatisfactory, and it is specially directed in the letter of Johns Hopkins to his Trustees. It cannot be properly put up for less than..... 25,000

Estimate for main buiidings, as above..... 450,000

Total reduced estimate.....\$770,000

Would such a Hospital be satisfactory to the Trustees? I am compelled to say that I think it would not. But before I make a positive recommendation on the subject permit me to state briefly some of the general principles which I think should influence the Trustees at the present time.

The Hospital should contribute to Charity, Education and Science. First to Charity. It is to furnish the best possible care and treatment to the sick. Its patients are to have the benefit of the best medical and surgical skill which can be procured, of properly trained nurses, of pure air and proper food, and they are not to be subjected to any annoyances or depressing influences by being made a show of in any way.

Their treatment by the Hospital authorities is to be in the same spirit in which they would be treated in their own homes.

I wish to make my views on this point distinctly and clearly understood, even at the risk of being tedious. A sick man enters the Hospital to have his pain relieved—his disease cured. To this end the mental influences brought to bear upon him are always important, sometimes more so than the physical. He needs sympathy and encouragement as much as medicine. He is not to have his feelings hurt by being, against his will, brought before a large class of unsympathetic, noisy students, to be lectured over as if he were a curious sort of beetle. Some men, and even women, are perfectly indifferent to being thus displayed, in fact rather like it, but there are many who regard it with aversion and fear, and will undergo much privation and suffering in their miserable homes rather than subject themselves to the exposure above referred to.

In this Hospital I propose that he shall have nothing of the sort to fear.

But we must be careful not to narrow and restrict the benefits of this charity. If we attempt to limit it absolutely to doing good to the patients in it, neglecting or refusing the claim which suffering humanity in general has to the benefit of the experience which we gain, we shall be acting unjustly and unwisely.

This Hospital should advance our knowledge of the causes, symptoms and pathology of disease, and methods of treatment, so that its good work shall not be confined to the city of Baltimore or the State of Maryland, but shall in part consist in furnishing more knowledge of disease and more power to control it, for the benefit of the sick and afflicted of all countries and of all future time.

It should be remembered that our buildings and machinery are simply tools and instruments, that the real Hospital,

the moving and animating soul of the institution, which is to do its work and determine its character, consists of the brains to be put in it. Whether it shall be a truly great Hospital and a charity such as was intended by its founder, is not a matter solely of arrangement and plan of buildings, it depends upon not more than half-a-dozen men and one or two women.

It depends also upon the organization of the medical department of the University, which in turn depends much for its success upon the arrangement of the Hospital. To this point I will allude more fully hereafter.

There are those who urge the adoption of the cheapest plan for buildings in order to save money to be applied to other purposes. It is supposed that if instead of building with a million we build with half that sum we shall have the income of the amount saved, viz: about \$30,000.00 per annum, to apply to educational and scientific purposes. This is not correct. The effect will simply be to open the Hospital about two and a half years earlier than on the other plan.

If we had as our sole object the care of the sick poor of the city of Baltimore, dealing with it as a contractor would do, we might perhaps accept this view.

But this Hospital is also to assist in educating physicians, in training nurses, in promoting discoveries in medicine, and the buildings required for these purposes cannot be made fit for their purpose with the smaller sum, neither can the saving proposed be by any means a clear gain, because of the increased amount of annual repairs which the cheaper buildings must entail.

I have intimated that the most difficult thing in forming this Hospital is not to plan the buildings, to decide how they shall be heated, or whether the ventilation shall be by a central aspirating shaft or otherwise, it is to find the proper and suitable persons to be the soul and motive power of the

institution, but it is also true that the plan and arrangement of the buildings will have a powerful influence upon those who are to manage the Hospital, stimulating them to exertion in certain directions, checking them in others, for carrying the analogy of the Hospital to a living organism a little farther—the body influences the soul as well as the soul the body.

It is by no means certain that with increase of salary beyond a certain amount we can get correspondingly better medical service or scientific work. It is at least as probable that the offering of facilities for observation and experiment, facilities in the shape of room, apparatus and organization, which shall make the sort of work which we desire to obtain not only easy, but actually more pleasant than mere routine duty; it is, I say, at least probable that money invested in this way will have as much power to produce the effect sought, and be as strong a stimulus, as if put into large salaries.

We can much more certainly secure men who will minutely and patiently investigate individual cases, noting every abnormal appearance or sound, testing every excretion, recording the precise effects of each plan of medication; in short doing everything which science can suggest to understand the condition of the patient and the best method of relieving him; by showing them that they shall have space and apparatus to work with, that the resources of modern science and mechanical skill shall be at their command, and that any discoveries which they may make shall be properly published, than by simply offering double pay.

Again, to secure these skilled physicians; original investigators imbued with the true scientific spirit; gentlemen; a certain amount of experiment and probation will be necessary. In very few cases indeed is it possible to say at first "This is precisely the man we want for the place." They must be taken on trial. This trial cannot be satisfactory

if we do not furnish the means. Such men as are wanted will at once request the means if they do not find them provided. Those who will not trouble the Trustees for more than they provide—and who will be the better pleased the less that they provide—are not the kind of men to be sought for.

After we have got our good men we want to keep them good. For our purposes there is no such thing as a man who “knows enough.” They are to improve steadily, to grow mentally, and for this growth we must provide nutriment and space just as certainly as we must provide them for the trees which we propose to plant, or else expect stunting, impaired vitality, and absence of fruit. The buildings are to be arranged with reference to these considerations, and it will be found that in the plans proposed no more space has been allowed for this purpose than is really advantageous. I not only cannot recommend any reduction in the general administration buildings or service buildings of the wards, but I think it would be judicious to increase a little the space allowed in some of these structures.

Very much the same line of thought applies to the buildings and parts of buildings intended for the female nurses and their training school. They will be influenced by their surroundings, and these should be made such as to best secure the class of women whom it is designed to employ and teach, and then to stimulate them to improvement. Giving each a separate room, with ample facilities for personal cleanliness, and providing places for their instruction, are wise provisions to this end, and I am unable to see how the size of the building arranged for this purpose can be advantageously reduced.

Let us now consider the University side of the Hospital question.

The letter of Johns Hopkins directs that “in all your arrangements in relation to this Hospital, you will bear

constantly in mind that it is my wish and purpose that the Institution shall ultimately form a part of the Medical School of that University for which I have made ample provision by my will."

It is evident that if the Hospital is completed and organized before the Medical School is commenced, the latter must to some extent be arranged to suit the former and *vice versa*. It is, therefore, necessary to endeavor to understand the general principles upon which the Medical School is to be organized. The first of these principles is that it shall, as far as possible, meet existing wants, do work which is not done or is not done in the best manner elsewhere in this country. The object of all Medical Schools in the United States is to make general practitioners, to instruct young men how to treat disease and injuries. In almost all this object is very imperfectly attained. But there are other objects for a Medical School which do not at all enter into the plan of existing institutions. One of these is to train men to be original investigators, to bring them face to face with the innumerable problems relating to life, disease and death, which are yet to be solved; to inspire them with the desire to investigate these questions, and to give them the training of the special senses, of manual dexterity, and, above all, of clearness and logical scientific precision of thought, which are required to fit them to be explorers in this field.

To do this, I think should be one of the objects of this Medical School. Another need of this country, which is supplied by no medical school in existence, is, for men properly qualified to act as health officers and sanitary authorities for our large cities, our States and by and by for the nation.

A man educated to be a practitioner of medicine only has very little of the special knowledge required by the man who is to advise as to the methods to be adopted by a great community to prevent or limit disease.

This special training I would have supplied by the Johns Hopkins' University.

A third branch of medicine, which is not taught in our schools, is the diagnosis, treatment and jurisprudence of insanity. I do not know if it will be possible to deal with this subject in this University, but I would keep this urgent want in mind, and the possibility of making connections with some public or private establishments devoted to the care of the insane, which can supply the necessary facilities and receive more than a corresponding benefit.

A fourth defect in most of our schools is the small amount of instruction given on the subject of diseases of children. The majority of the cases which the practitioner has to treat are in children and women, while the most of his practical instruction is received from adult males.

This defect, our Medical School will have peculiar facilities for supplying.

In laying stress on these four points, I do not mean that the usual branches of the medical curriculum are to be neglected—these things are to be done and the others not left undone—but I mean that the main *object* of this School should not be to make general practitioners; though incidentally it would make the best of such, and especially such as are needed for the Government medical services; neither should it be to make oculists or aurists or gynæcologists, because it cannot surpass the facilities for teaching those specialties which exist elsewhere.

Keeping in view the results which we desire to obtain, and especially the first, which is the most important, we come to the second general principle in organization, which is, that this knowledge is not to be mainly acquired from text books or lectures, but from observation, experiment and personal investigation.

What the teacher can do is to inspire in the student the desire to learn, show him how to go to work, give him facilities and encourage him, and smooth over difficulties.

This implies that more extensive facilities in the way of rooms, instruments and apparatus are to be furnished than is usual in medical schools, and that the labor of the instructors will be largely in the laboratories and working rooms, supervising and directing the investigations of each student. Lecturing will be the smallest part of the duty of these professors.

This again implies that the classes will be small, which will certainly be the case at first, and we need not consider as to what shall be done with large classes until the necessity arises, which I think will never happen.

The third general principle in organization is not to waste time and labor on men not fitted to receive the kind of instruction which we propose to give. We do not wish to have the time of our instructors wasted on, or our real students crowded and distracted by men who, by reason of ignorance and indolence, are incapable of doing what we wish them to do. This implies examinations preliminary, and from time to time during the course, at least when the student passes from one set of studies to another. It also implies a graded course, that the studies at the beginning shall be different from, and preparatory to those towards the end of the course. I believe these general principles to be in harmony with the wishes and plans of those charged with the organization of the University as set forth in the inaugural address of President Gilman,

If this be so, it follows that the term of medical studies will occupy four years for the general course, and that this will be divided into two parts. In the first part the student will be engaged with the principles, theories and general formulæ, and this belongs exclusively to the University. During this period it will be very seldom indeed, that the student has anything to do in the Hospital or should be admitted to it, and on these rare occasions he will go to the amphitheatre only. It is, for instance, possible that in case

of the occurrence of some rare and remarkable surgical operation, which a student can expect to see but once during his course, it would be advisable to permit even the first year's students to witness it, but such cases would be exceptional.

During the second part of his course, the student is to apply the principles to practice, is to receive clinical instruction, is clinically to instruct himself. To this end he must see and examine cases of disease, he must work in the Hospital and Dispensary.

It may be asked, how can this be done, and yet preserve the perfect independence of the Hospital and the University, and also preserve what I have above insisted on, that the bodily and mental comfort of the patients shall not be interfered with except for their own personal good.

I reply that it is not only possible, but easy to do this, and that the comfort and welfare of the patients shall not only be not injured but be promoted by the presence of these students.

Reflect a moment as to what sort of persons these students, selected and trained as I have indicated, will be, and do not let the word "student" mislead you into taking for granted that they will correspond in tastes, habits or manners to the ordinary ideal of a medical student. There will be as much difference as there is between an architect and a bricklayer.

Remember also that one of the principles on which the Medical School is founded is that the classes shall be small. If they are limited in no other way they should be by the consideration that the whole of the Graduating Class should be employed in the Hospital, and that this number cannot exceed twenty-five (25), making the maximum number in the Medical School about 120. I do not think it necessary or proper to go into any details at this time with regard to the adjustment of the relations of the two Institutions:

those details will settle themselves as the organization progresses.

The Hospital has other very important interests to consider besides those of the School, just as the University has other interests besides those of the Hospital; but they intersect each other like two circles, having a certain area which is common to both, where whatever affects the one affects the other. The language of the founder of these trusts is very plain, and I have as little doubt about his wish as about the practical wisdom which dictated it. He says, "*It is my wish and purpose that the Institution shall ultimately form a part of the Medical School of that University.*"

Whether the "surgeons and physicians of the highest character and greatest skill," whom "it will be your especial duty to secure for the service of the Hospital," are to be officials of the University, or of the Hospital, matters little at present, but they must certainly be the clinical teachers, the men who are to receive the student after he has finished his preliminary and theoretical studies, decide whether he is fitted to undertake the practical part, and if he is so fitted, teach him in the Dispensary and Hospital, which, for this purpose, "*form a part of the Medical School.*"

I am, then, of the opinion that in planning the Hospital the necessity of providing space for those students, who are to reside and study in it, should be taken into account, and that in any reduction great care should be taken not to interfere with the interests of the University.

To sum up. To build a Hospital which, to use the words of Johns Hopkins, "shall compare favorably with any other institution of like character in this country or in Europe," which shall furnish the best treatment and accommodations for patients, promote advance in medical science, secure, retain and improve such medical officers

and nurses as are desired, consult the best interests of the University, and form a suitable monument to and memorial of its founder, will cost at least one million of dollars, and take four years income in addition to that which is now available. I respectfully recommend that plans on this basis be authorized.

If this be not approved, then I recommend that *all* the buildings be built with regard to cheapness mainly, at a total cost of about \$350,000, abandoning entirely the general plan of which I have been speaking.

I advise that no attempt at a compromise between these two courses be attempted, for if it is, the result will be satisfactory to nobody.

If it be decided to build the complete and comparatively costly structure which I have recommended, the question may arise as to whether it may be desirable to begin to receive patients before the Hospital is completed. In favor of this it may be urged that it will give some facilities for testing the work as it goes on, for gaining some information as to the classes of patients which are to be provided for, and, finally, which is the strongest argument, for getting a small staff of physicians, nurses and employees in good working order, which will be a nucleus for the instruction of others.

In opposition to it, it should be noted that if a part of the income is taken for care of patients the time of building must be extended, and that it will be highly objectionable to patients and all concerned to have building operations going on for twelve or fifteen years.

It is a question which requires no decision at present and only comes up in connection with another question which may arise in connection with deciding the time to be taken for construction, viz: When will the University probably desire that the Hospital shall be in readiness to co-operate with the Medical Department?

If anything like the plan of organization which I have indicated be adopted it is evident that the Medical School must have been in operation for two years before it will have any students fitted to commence the Hospital part of the course.

As the Medical Faculty will probably not be organized in less than two years, it will probably be at least four years before it is ready for the Hospital. The Hospital should be ready to join in the work of the Medical School at a certain time or there will be a loss of power to the School; but if the Hospital is put into practical operation before the School is properly organized there will be a loss of power to the Hospital.

The first classes of the Medical School will be small. I think that there will not be more than ten students ready for the Hospital advantages by 1880.

So far as the wants of the University are concerned I conclude that if by that time the out-door Dispensary is in good working order it would be sufficient for another year; *i. e.*, until 1881. This Dispensary is a very important part of the Hospital organization, and may be made the means of doing a much greater amount of good than such institutions usually effect. Through it the majority of the Hospital patients will probably be selected, and there are many reasons why its service should be organized and put into operation before the Hospital proper is opened for patients. It is not desirable to discuss or decide this point at present, but it should be kept in view in settling the main question now under consideration, *viz*: That of general plan and character of buildings in connection with questions of cost, and time to be allowed for construction.

With this is connected a suborninate question, namely: When shall actual operations looking to construction, such as grading, etc., be commenced?

The nature of the ground is such that whenever grading is commenced, it will be desirable to lay at the same time the foundations of the majority of the buildings on the south and west sides, in order to avoid subsequent excavations in ground which has been filled in.

This involves decision as to plan and arrangement of these buildings, and in fact of nearly every building in the Hospital, for we should have the detailed working drawings of every building prepared before we begin actual construction.

If an attempt were made to begin this fall, this decision must be made at once, and the methods of heating and ventilation must be settled without delay.

I strongly prefer not to attempt to positively decide these questions at this time. I hope to be able to visit Europe during the coming autumn, and obtain certain data there which I require, and I also wish to have the results of certain experiments and observations which will be made during the coming winter in a hospital near Washington, which presents peculiar facilities for that purpose, having been so arranged that the relative merits of upward and downward ventilation; of impulsion by the fan versus aspiration by a chimney, etc., etc., can be determined with a fair degree of scientific precision.

If it is necessary that I should advise at once on this point I shall recommend that the heating be by hot water, with large surfaces at a comparatively low temperature, and that the buildings devoted to administration, and the pavilions on the north side be heated from one set of boilers connected with the kitchen building. I shall further recommend that each pavilion on the south side have its own heating apparatus, and that for all other buildings the fresh air flues shall be connected with a powerful fan placed in the kitchen building.

With the information which I now have with regard to the working of large aspirating chimneys, I would not

assume the responsibility of recommending that we rely upon one great chimney for the ventilation of the whole Hospital, as you think of doing, though it is quite probable that it would be satisfactory. I am certain that the effect desired can be produced by a Fan of proper capacity, and with properly adjusted ducts, and the calculations for these are comparatively easy, while so far as I can obtain positive information from engineers and works on the subject the difference in cost between the two methods for an institution of this size is so small that it need not be taken into account.

These remarks on heating and ventilation are based on the supposition that the Hospital is to be built according to the latest plan, at a cost of about \$1,000,000.

If it is to be built cheap I shall advise that each building be ventilated by itself, mainly on what is known as the natural system.

In either case I recommend that the work of grading, etc., be not commenced until next Spring.

Very respectfully,

Your obedient servant,

JOHN S. BILLINGS,

Asst. Surg. U. S. A.

ESTIMATE A.

Approximate Estimate of Cost of Johns Hopkins Hospital.

1. Administration Building, finished with freestone work and brick to the extent of the Y. M. C. A. Building, [18 cts.]..	\$138,000
2. Two Pay Wards, brick and stone dressings, do. 14 cts., at \$46,000.....	92,000
3. Kitchen Building and Boiler-house, [15 cts.].....	81,000
If fire-proof, add.....	18,000
4. Nurses Dwellings and Out-door Patients Dispensary, [14 cts.]..	77,000
5. Adjunct of Back Service Building of Administration, [12 cts.]	29,000
6. Medical Directors Dwelling, [13½].....	16,000
8. Twelve Common Wards and Service Buildings, at \$24,000 each.....	288,000
9. Two Isolating Wards at \$32,000, [13½ cts.].....	64,000
10. Amphitheatre, [18 cts.].....	58,000
11. Stable, Carriage-house and Repair Shops.....	10,000
12. Dead-house and Autopsy Building.....	12,000
13. Gardner's and Gate Lodge and Green-house.....	10,000
14. Receiving Depot and Carriage Sheds.....	6,000
15. Connecting Corridors [1,900 feet] at \$15,000.....	28,500
16. Foul Air Ducts for Central Ventilation.....	19,000
17. Great Central Shaft, 10 feet square, clear 200 feet high, [3 feet average walls.].....	16,000
18. Grading of Lot and Sewerage.....	35,000
19. Enclosing Wall of Lot, Railing and Gate Ways [3,100 feet], \$10.....	31,000
Total	\$1,028,500

Baltimore, July 8, 1876.

The above estimates contemplate well constructed brick buildings, faced with front brick, stone window sills, granite ashlar, 18 inches to 2 feet high, above the ground, the *stairs* and *corridors* of all the buildings fire-proof. Outside iron, revolving shutters to the Hospital wards only. No decoration or architectural embellishments beyond a decent outside cornice of moulded brick or galvanized iron. For the administration building, stone dressings on the fronts to the value of \$36,000, and \$10,000 for each pay ward are allowed, colored brick and band courses, and a fair amount of finish to the interior of the principal floor of the administration building.

ESTIMATE B.

Estimate of Rectangular Pavilion. [Ward only.]

1. Excavation and Labor, 600 yards at 25 cents, and labor \$100..\$	250
2. Brickwork, 170,000 bricks at \$18, faced with front brick.....	3,060
3. Granite Ashlar and Silis [Ashlar 18 inches high].....	668
4. Portland Cement Concrete, 3,500 square feet by 2 feet deep, 7,000 cubic feet at 25 cents.....	1,750
5. Carpenters Work and Lumber \$1,600, Outside Blinds of Iron \$1,000.....	2,600
6. Painting and Glazing, double sash, double thick glass.....	300
7. Hardware.....	200
8. Slate Roof and Gutters.....	700
9. Galvanized Iron Cornice, 264 feet at \$2.....	528
10. Gas Pipes.....	50
11. Plastering with Polished Parian Cement, 820 yards at \$1.....	820
12. Heating by Hot Water, 48,000 cubic feet at 2½ cents.....	1,200
13. Fire proofing of Ward Floor.....	2,600

Total.....\$14,726

Contents of Ward 108,800 cubic feet, or 13½ cents per cubic foot,

Contents of Service Building 62,252 cubic feet, at 15 cents [corridor

and stairs to be fire-proof] 9,337

\$24,063

The following is an estimate for an Octagon Ward of 58 feet diameter.

Square of Ward 3,164 square feet by 34 feet high, 107,576 cubic feet at 14 cents.....	\$15,060
Extra height of Centre Shaft, 40 feet.....	740

Total cost of Octagon Ward.....\$15,800

Service Building the same as other..... 9,337

\$25,137

Baltimore, July 8th, 1876.

